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The Potential Scale of Aeolian Structures on Venus

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Simulations of the Venusian aeolian environment with the Venus Wind Tunnel have shown that microdunes are formed during the entrainment of sand-size material. These structures are several tens of centimeters long (2-3 cm high) and combine the morphological and behavioral characteristics of both full-scale terrestrial dunes and current ripples formed in subaqueous environments. Their similarity to both reflects the fact that the Venusian atmosphere has a density intermediate between air and water. Although the development of microdunes in the wind tunnel experiments was limited by tunnel dimensions, it is possible to make some predictions about their potential size on Venus, and the potential size of related aeolian structures.

Microdunes are fluid-formed structures (as are dunes and current ripples) and as such have no theoretical upper limit to their size from a fluid-dynamics standpoint. Limitations to size observed in subaqueous structures are set by, for example, water depth; limitations to the size of dunes is set by, for example, sand supply. It is therefore reasonable to suppose that microdunes on Venus could evolve into much larger features than those observed in experiments. In addition, we note that current ripples (which are closely related to microdunes) are often found in association with giant ripples that have dimensions similar to aeolian dunes. Thus, it may also be reasonable to assume that analogous large-scale structures occur on Venus. Both (terrestrial) aeolian and subaqueous environments generate structures in excess of one hundred meters in wavelength. Such dimensions may therefore be applicable to Venusian bedforms. Analysis of Magellan data may resolve this issue.